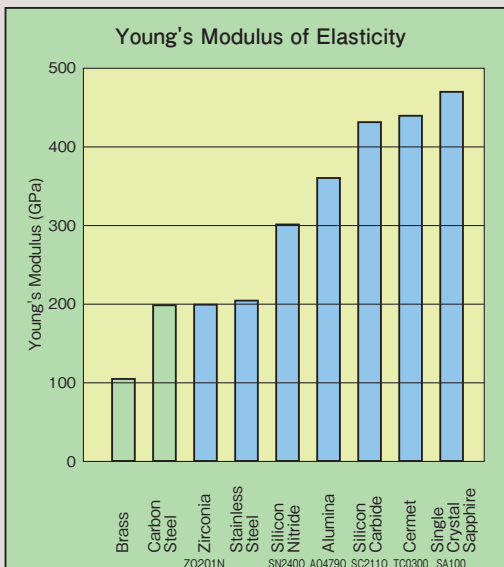
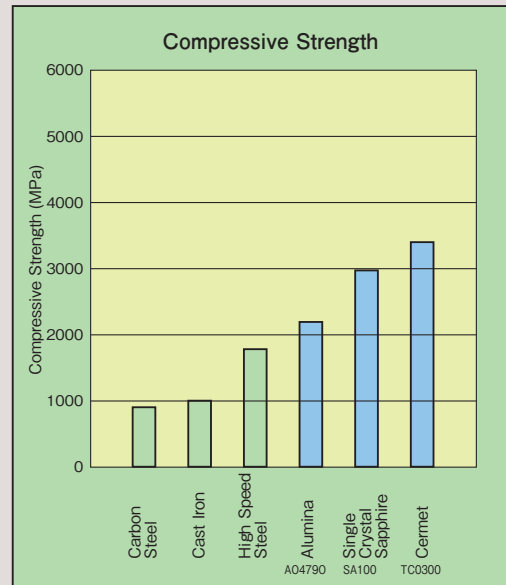
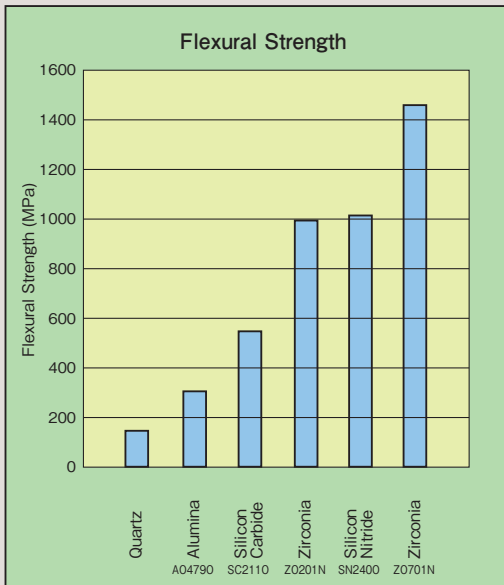
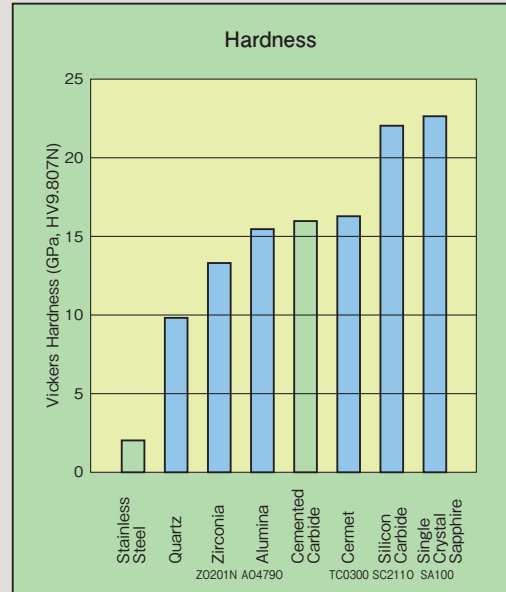
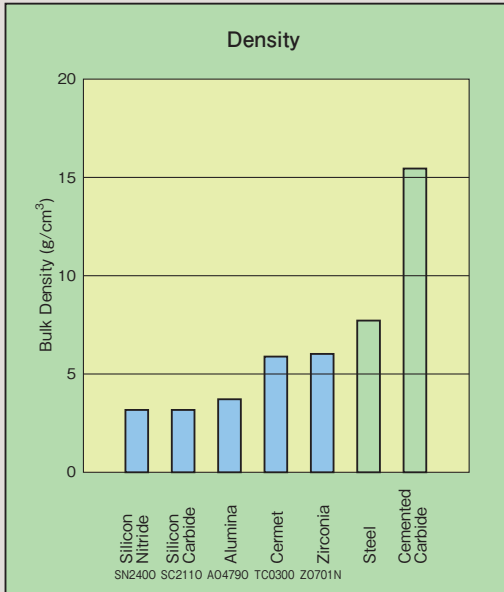


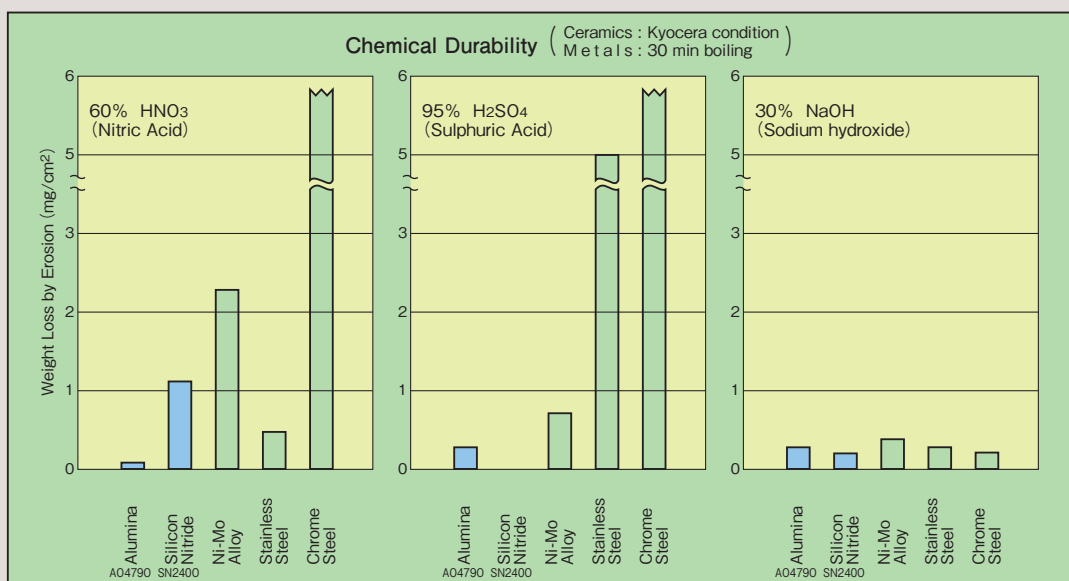
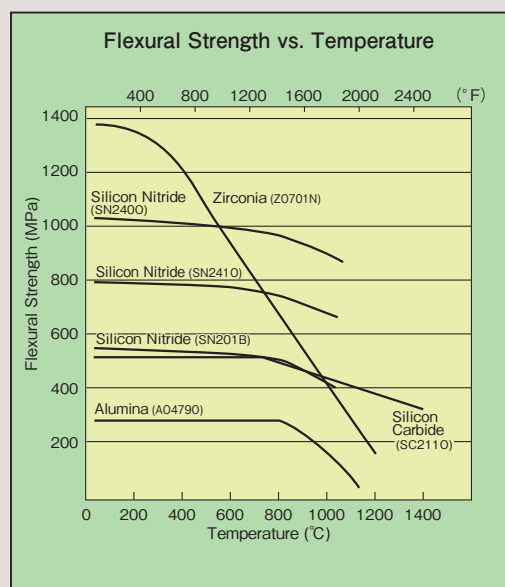
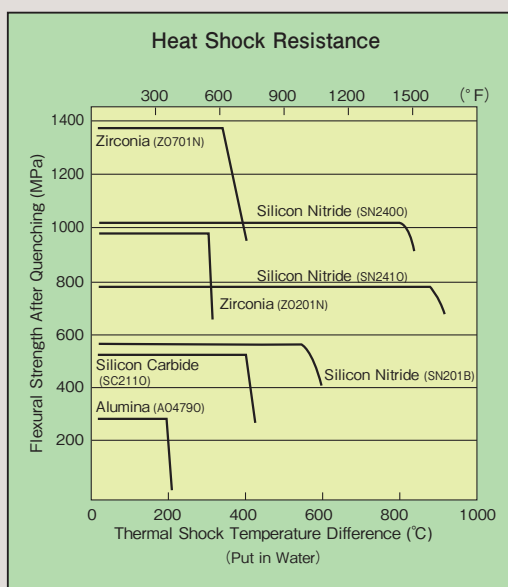
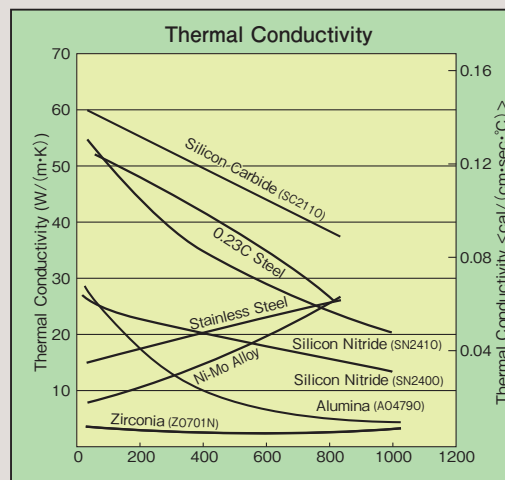
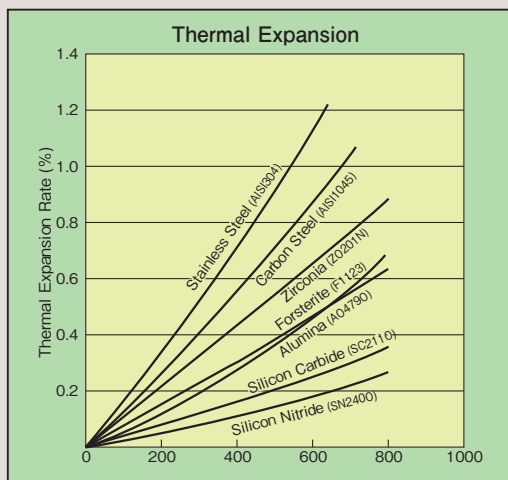
THE NEW VALUE FRONTIER



**CHARACTERISTICS
OF
KYOCERA
FINE
CERAMICS**

MATERIAL COMPARISON CHARTS





Unit Conversion Table

Stress		
MPa or N/mm ²	kgf/mm ²	psi (=lbf/in ²)
1	1.020 × 10 ⁻¹	1.450 × 10 ²
9.807	1	1.422 × 10 ³
6.895 × 10 ⁻³	7.031 × 10 ⁻⁴	1

Thermal Conductivity

W/(m · k)	kcal/(m · h · °C)	cal/(cm · sec · °C)
1	8.600 × 10 ⁻¹	2.389 × 10 ⁻³
1.163	1	2.778 × 10 ⁻³
4.186 × 10 ²	3.600 × 10 ²	1

CHARACTERISTICS of Kyocera Fine Ceramics (1)

Item				Material	ALUMINA (Al ₂ O ₃)							
Material Code (Old)				A482R	A459	A445	A471	A473	A484	A476	A479	
Material Code (New)				AO482R	AO459K	AO445O	AO471O	AO473O	AO484O	AO476O	AO479O	
Appearance				Porous	Dense							
Color				Pink	Russet	Dark Brown	White	White	White	White	White	
Content (%)				Al ₂ O ₃ 76	89	90	92	92	92	96	99	
Main Characteristics				High Mechanical Strength, High Temperature Resistance, High Frequency Insulation								
				●High Heat Resistance	●Good for Metallizing	●Light Intercepting, ●High Heat Dissipation	●Wear Resistant	●Good for Metallizing, ●Mechanically Strong	●Wear Resistant	●Good Surface Smoothness	●Hard and Chemically Stable	
Main Applications				●Welding Nozzle, ●Nozzle for Glass Fiber Manufacturing	●Magnetron	●IC Packages	●Liner ●Pulverizer	●IC Multi-Layer Packages, ●Electron-tube Housing	●Wire- Drawing Parts, ●Capstans, Mechanical Seal Rings	●Hybrid IC Substrates	●Heat, Corrosion and Wear Resistant Parts	
Density (*1)		g/cm ³	JIS R 1634	3.6	3.6	3.8	3.6	3.6	3.6	3.7	3.8	
Water Absorption		%	JIS C 2141	0.6	0	0	0	0	0	0	0	
Mechanical Characteristics	Vickers Hardness HV9.807N		GPa	JIS R 1610	9.0	12.1	12.7	11.8	12.3	12.3	13.7	15.2
	Flexural Strength 3 P.B.		MPa	JIS R 1601	120	310	320	390	340	370	350	310
	Compressive Strength		MPa	JIS R 1608	—	—	—	—	2,300	—	—	2,160
	Young's Modulus of Elasticity		GPa	JIS R 1602	160	280	320	280	280	280	320	360
	Poisson's Ratio		—		0.17	0.23	0.23	0.23	0.23	0.23	0.23	0.23
	Fracture Toughness (SEPB)		MPa · m ^{1/2}	JIS R 1607	—	—	—	—	—	—	—	3 ~ 4
Thermal Characteristics	Coefficient of Linear Thermal Expansion	40 — 400℃	× 10 ⁻⁶ /K	JIS R 1618	7.1	7.0	7.3	7.1	6.9	6.8	7.2	7.2
		40 — 800℃			7.5	7.9	8.1	7.9	7.8	7.7	7.9	8.0
	Thermal Conductivity 20℃		W/(m · K)	JIS R 1611	8	14	12	16	18	17	24	29
	Specific Heat Capacity		J/(g · K)	JIS R 1611	0.75	0.75	0.75	0.79	0.78	0.78	0.78	0.79
	Thermal Shock Temperature Difference (Put in Water, Relative Method)		℃	JIS R 1648	320	—	—	200	200	200	200	200
Electrical Characteristics	Dielectric Strength		kV/mm	JIS C 2141	12	15	12	16	16	14	15	15
	Volume Resistivity	20℃	Ω · cm		> 10 ¹⁴	> 10 ¹⁴	10 ¹¹	> 10 ¹⁴	> 10 ¹⁴	> 10 ¹⁴	> 10 ¹⁴	> 10 ¹⁴
		300℃			10 ¹⁰	10 ¹⁰	10 ⁷	10 ¹²	10 ¹²	10 ¹⁰	10 ¹⁰	10 ¹⁰
		500℃			10 ⁸	10 ⁸	10 ⁵	10 ⁹	10 ¹⁰	10 ⁸	10 ⁸	10 ⁸
	Dielectric Constant (1MHz)		—		8.4	8.8	9.8	8.9	9.0	8.9	9.4	9.9
	Dielectric Loss Angle (1MHz)		(× 10 ⁻⁴)		180	6	20	6	6	9	4	2
	Loss Factor		(× 10 ⁻⁴)		1,500	52	190	53	54	80	38	20
Chemical Characteristics	Nitric Acid (60%) 90℃ ,24H		(Weight Loss) mg/cm ²	—	—	—	—	—	0.32	0.14	—	0.10
	Sulphuric Acid (95%) 95℃ ,24H				—	—	—	—	0.65	0.34	—	0.33
	Sodium Hydroxide (30%) 80℃ ,24H				—	—	—	—	0.91	0.95	—	0.26

The values are typical material properties and may vary according to products configuration and manufacturing process. For more details, Please feel free to contact us.

* 1: All values for apparent density and bulk density are the same, except for A482R which lists apparent density only.

				SAPPHIRE		CORDIERITE (2MgO · 2Al ₂ O ₃ · 5SiO ₂)		STEATITE (MgO · SiO ₂)		FORSTERITE (2 MgO · SiO ₂)	
A479S	A479M A479G	A480S	A601D A601L	SA100		CO220	CO720	S210	S211	F1120	F1023
AO479S	AO479M AO479G	AO480S	AO601D AO601L	SA100		CO2200	CO7200	SO2100	SO2110	F11200	F10230
				Dense		Dense	Dense	Dense		Dense	
Ivory	Ivory	Ivory	Ivory	Transparent		Gray	Gray	White	Dark Brown	Light Yellow	
99.5	99.5	99.7	99.9	99.99		—	—	—	—	—	—
on, High Chemical Resistance				Single Crystal		●Very Low Thermal Expansion ●Light Weight		●Thermal Insulator	●Good Light Shield	●Good Surface Finish	●High Thermal Expansion
●Hard and Chemically Stable, ●Fine Grain Strong and Smooth	●High Chemical Resistance,	●Good Anti-Plasma, ●Wear Resistance ●High Purity		●High Heat Resistance, ●High Chemical Resistance							
●Pump ●Shafts	●Wear Resistant Parts ●Chemically Ressitant Parts ●Semiconductor Processing Equipment Parts			●Thin Film Substrates, ●Windows, ●Chemically Resistant Parts		●Lithography Stage Component ●Wafer Inspection Stage Component ●SEM/TEM		●Various Circuit Parts		●Substrate For Resistor ●Core For Resistor	
3.9	3.9	3.9	3.9	3.97		2.5	2.5	2.8	3.1	3.0	3.0
0	0	0	0	0		0	0	0	0	0	0
16.0	15.7	17.2	17.5	Surface a	22.5	8	8.5	5.8	6.7	7.3	5.9
360	370	380	400	Surface a Axis c	690	190	200	190	220	180	160
2,350	—	—	—	2,940		—	—	—	—	—	—
370	370	380	380	470		140	145	120	130	150	150
0.23	0.23	0.23	0.23	—		0.31	0.31	0.22	0.22	0.24	0.24
4	—	—	5 ~ 6	—		1 ~ 1.5	1 ~ 1.5	—	—	—	—
7.2	7.2	7.2	7.2	Parallel to Axis c	7.7	1.5 (40℃~ 400℃) 2.1 (40℃~ 800℃)	1.5 (40℃~ 400℃) 2.1 (40℃~ 800℃)	7.7	9.2	9.7	10.1
8.0	8.0	8.0	8.0	Vertical to Axis c	7.0	< 0.05 (23℃) < 0.02 (22℃)	< 0.05 (23℃) < 0.02 (22℃)	8.0	10.4	—	—
32	32	32	34	41		4	4	2	3	5	5
0.78	0.78	0.79	0.78	0.75		0.71	—	0.75	0.72	0.78	0.75
250	—	—	—	—		—	400	—	—	—	—
15	15	15	15	48		19.1	19.3	18	14	17	13
> 10 ¹⁴	> 10 ¹⁴	> 10 ¹⁴	> 10 ¹⁴	> 10 ¹⁴		> 10 ¹⁴	>10 ¹⁴	> 10 ¹⁴	> 10 ¹³	> 10 ¹⁴	> 10 ¹⁴
10 ¹³	10 ¹³	10 ¹³	10 ¹³	—		10 ¹²	10 ¹²	10 ¹⁰	10 ⁹	10 ¹³	10 ⁹
10 ¹⁰	10 ¹⁰	10 ¹⁰	10 ¹⁰	10 ¹¹		10 ¹⁰	10 ¹⁰	10 ⁷	10 ⁷	10 ¹⁰	10 ⁹
9.9	9.9	9.9	9.9	Parallel to Axis c Vertical to Axis c	11.5 9.3	4.9	4.9	6	8	6.5	6.5
1	1	1	1	< 1		9	8.5	18	750	3	5
10	10	10	10	—		—	—	108	6,000	20	30
0.07	—	0.05	0.03	≐ 0.00		—	—	—	—	—	—
0.25	—	0.22	0.19	≐ 0.00		—	—	—	—	—	—
0.05	—	0.04	0.03	≐ 0.00		—	—	—	—	—	—

1kgf/mm² = 9.807MPa

1cal/(cm · sec · °C) = 418.6W/(m · K)

CHARACTERISTICS of Kyocera Fine Ceramics (2)

Item				Material	YTTRIA (Y ₂ O ₃)	TITANIA			SILICON CARBIDE (SiC)		SiN
Material Code (Old)					YO100A	T716	T716H	T792H	SC211	SC1000	SN201B
Material Code (New)					YO100A	TO716O	TO716H	TO792H	SC211O	SC1000	SN201B
Appearance					Dense	Dense			Dense		
Color					White	Light Brown	Light Brown	Grayish Yellow	Black	Black	Black
Content (%)					—	—	—	—	—	—	—
Main Characteristics				● Good Plasma Resistance	Good Surface Finish			● High Temperature Strength ● High Chemical Resistance, Excellent Thermal ● Conductivity			
					● CaTiO ₃		● BaTiO ₃				
					● Fracture Toughness		● Chemical Resistance				
Main Applications				● SPE Parts	● Slider Pads for Disk Drive Heads			● Mechanical Seal, ● High Temperature Resistance Parts			
Density (*1)		g/cm ³	JIS R 1634	4.9	3.9	4.0	4.5	3.2	3.16	3.2	
Water Absorption		%	JIS C 2141	0	0	0	0	0	0	0	
Mechanical Characteristics	Vickers Hardness HV9.807N		GPa	JIS R 1610	6.0	8.5	8.8	8.1	22.0	23.0	13.9
	Flexural Strength 3 P.B.		MPa	JIS R 1601	130	320	320	230	540	450	580
	Compressive Strength		MPa	JIS R 1608	—	—	—	—	—	—	—
	Young's Modulus of Elasticity		GPa	JIS R 1602	160	260	270	180	430	440	290
	Poisson's Ratio		—		—	—	—	—	0.16	0.17	0.28
	Fracture Toughness (SEPB)		MPa・m ^{1/2}	JIS R 1607	1.1	—	—	—	4 ～ 5	2 ～ 3	4 ～ 5
Thermal Characteristics	Coefficient of Linear Thermal Expansion	40 — 400℃	× 10 ⁻⁶ /K	JIS R 1618	7.2	11.5	11.5	9.6	3.7	3.7	2.4
		40 — 800℃			7.6	12.1	12.1	—	4.4	4.4	3.2
	Thermal Conductivity 20℃		W/(m・K)	JIS R 1611	14	4	4	2	60	200	25
	Specific Heat Capacity		J/(g・K)	JIS R 1611	0.45	0.71	0.71	0.59	0.67	0.67	0.64
	Thermal Shock Temperature Difference (Put in Water, Relative Method)		℃	JIS R 1648	—	—	—	—	400	—	550
Electrical Characteristics	Dielectric Strength		kV/mm	JIS C 2141	11	—	—	—	—	—	—
	Volume Resistivity	20℃	Ω・cm		>10 ¹³	10 ¹²	10 ¹²	10 ¹²	10 ⁵	10 ⁸	>10 ¹⁴
		300℃			10 ¹⁰	—	—	—	10 ⁴	10 ⁴	10 ¹²
		500℃			10 ⁷	—	—	—	10 ³	10 ³	10 ¹⁰
	Dielectric Constant	(1MHz)	—		11	—	—	—	—	—	—
	Dielectric Loss Angle	(1MHz)	(× 10 ⁻⁴)		5	—	—	—	—	—	—
	Loss Factor		(× 10 ⁻⁴)		55	—	—	—	—	—	—
	Chemical Characteristics	Nitric Acid (60%) 90℃, 24H			(Weight Loss) mg/cm ²	—	—	—	—	—	0.04
Sulphuric Acid (95%) 95℃, 24H		—	—	—			—	0.01	≒ 0.00	—	
Caustic Soda (30%) 80℃, 24H		—	—	—			—	≒ 0.00	≒ 0.00	—	

The values are typical material properties and may vary according to products configuration and manufacturing process. For more details, Please feel free to contact us.

*1: All values for apparent density and bulk density are the same, except for A482R which lists apparent density only.

SILICON NITRIDE (Si ₃ N ₄)		ALUMINIUM NITRIDE (AlN)		ZIRCONIA (ZrO ₂)				CERMET
SN240	SN241	AN216A	AN2000	Z220	Z201N	Z701N	Z21H04	TC30
SN240O	SN241O	AN216A	AN2000	ZO220O	ZO201N	ZO701N	Z21H04	TC0300
Dense		Dense		Dense				Dense
Black	Black	Gray	Ivory	Yellow	Ivory	Ash Black	Black	Silver
—	—	—	AlN 99.9	—	—	—	—	—
<ul style="list-style-type: none">●High Temperature Strength●Wear Resistant●Excellent Thermal Shock Resistance●Light Weight		<ul style="list-style-type: none">●High Electrical Insulation,●High Thermal Conductivity		<ul style="list-style-type: none">●High Mechanical Strength,●Excellent Wear Resistance,●Good Surface Finish,●High Fracture Toughness				<ul style="list-style-type: none">●High Mechanical Strength,●Excellent Wear Resistance,●High Heat Shock Resistance,●Electrical Conductivity
●Haigh Strength, High Temperature Durability	●High Thermal Conductivity	●Excellent Thermal Conductivity	●High Purity, ●Good Plasma Resistance					
<ul style="list-style-type: none">●Anti Wear Liner●Powder Equipment●Molten Metal Parts●Metal Forming Tool		<ul style="list-style-type: none">●Heat Uniformity Parts,●High Temperature Treatment Fixtures,●Semiconductor Processing Equipment Parts		<ul style="list-style-type: none">●Pump Parts, Dies, Knives,●Cutting Blades, Spikes,●Club Faces, Scissors				<ul style="list-style-type: none">●Cutting Tool Tips,●Wear Resistant Parts,●Metal Forming Tools
3.3	3.2	3.4	3.2	5.6	6.0	6.0	5.6	6.0
0	0	0	0	0	0	0	0	0
14.0	13.8	10.4	11.2	10.7	12.3	12.7	10.8	16.2
1,020	790	310	220	750	1,000	1,470	710	1,470
—	—	—	—	—	—	—	—	3,430
300	290	320	310	200	200	220	210	440
0.28	0.28	0.24	0.24	0.31	0.31	0.31	—	0.21
7	6 ~ 7	—	—	7 ~ 8	4 ~ 5	4 ~ 5	3 ~ 4	—
2.8	2.9	4.6	4.6	10	10.5	10.8	10.3	7.4
3.3	3.5	5.3	5.2	10.5	11.0	11.3	11.4	8.3
27	54	150	67	3	3	3	3	17
0.65	0.66	0.71	0.72	0.46	0.46	0.46	0.48	—
800	900	—	—	450	300	350	—	310
13	12	14	16	13	11	—	—	—
>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	10 ¹³	—	10 ⁸	10 ⁻⁴
10 ¹²	10 ¹²	10 ¹⁰	10 ¹¹	10 ⁶	10 ⁶	—	—	—
10 ¹⁰	10 ¹⁰	10 ⁸	10 ⁹	10 ⁴	10 ³	—	—	—
9.6	9.6	8.6	8.5	28	33	—	—	—
19	18	3	2	17	16	—	—	—
—	—	26	17	476	520	—	—	—
1.11	0.18	—	—	—	≐ 0.00	≐ 0.00	—	6.0
0	0	—	—	—	0.04	0.04	—	0.26
0.22	0.07	—	—	—	0.08	0.08	—	0.02

1kgf/mm² = 9.807MPa

1cal/(cm · sec · °C) = 418.6W/(m · K)

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